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# DISTRIBUTION OF FISHING BY PURSE SEINE VESSELS FOR ATLANTIC MENHADEN, 1955-59

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# DISTRIBUTION OF FISHING BY PURSE SEINE VESSELS FOR ATLANTIC MENHADEN, 1955-59

by

Charles M. Roithmayr

United States Fish and Wildlife Service
Special Scientific Report--Fisheries No. 434

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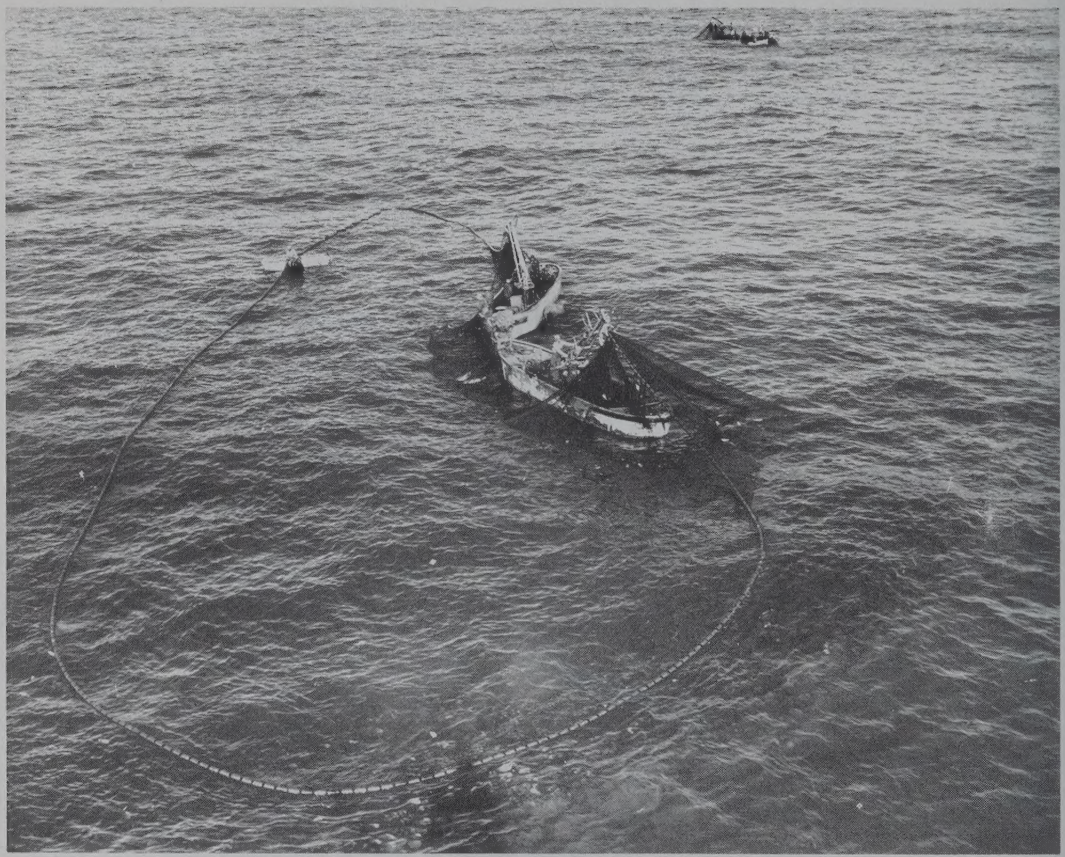

Frontispiece: Menhaden purse seine in operation. "Power blocks" haul the net aboard the two purse boats until the fish are concentrated in the bunt.

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# DISTRIBUTION OF FISHING BY PURSE SEINE VESSELS FOR ATLANTIC MENHADEN, 1955-1959

by

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## ABSTRACT

The number and location of purse seine sets recorded in logbooks and the number of vessel landings at reduction plants were compiled and estimates made of the total number and distribution of sets for Atlantic menhaden, *Brevoortia tyrannus*, during five seasons, 1955-59. Number of sets, by month and area, is given, and variations are noted. Distribution of sets by month is shown graphically. Apparent fish movements were inferred from the distribution of sets.

## INTRODUCTION

One of the objectives of the research by the Bureau of Commercial Fisheries on the Atlantic menhaden, *Brevoortia tyrannus*, is to determine whether the present rate of fishing exceeds that which would permit the maximum sustainable catch from the population. To accomplish this objective, continuing measures of fishing effort and catch are required to establish the relation between variations in population abundance and the amount of fishing. Information on the number (a measure of fishing effort) and location of sets by the purse seine fleet has been obtained through a logbook system since the inception of the research program. This report summarizes the information collected during five fishing seasons, 1955-59. The purposes are to (1) record part of the basic effort data from which measures of abundance may be calculated, and (2) show graphically the distribution of fishing. Variations in fishing are discussed, and some inferences concerning the movements of Atlantic menhaden are drawn from the data.

## DISTRIBUTION OF ATLANTIC MENHADEN

Atlantic menhaden are distributed along the Atlantic coast of North America from Nova Scotia to central Florida, but are not equally

[1] Present address: Bureau of Commercial Fisheries, Technological Laboratory, U.S. Fish and Wildlife Service, Pascagoula, Miss.

available throughout the range at all times. During the warmer months, the fish congregate in schools which are found in greater concentrations in waters of less than 20 fathoms overlying the inner third of the Continental Shelf. Through the summer, young-of-the-year fish apparently are confined to estuaries, while older fish usually are found in the open waters along the shore and in some of the larger bays. In late autumn, schools of juveniles and adults are found only off the coast of North Carolina, and through most of the winter, the fish seldom are seen in the coastal waters. The reappearance of schools in the inshore waters in spring is coincident with the increase in water temperature.

## THE PURSE SEINE FISHERY

The purse seine fishery for Atlantic menhaden operates on schools which are differentially distributed in the inshore waters during two separate periods. The "summer" fishery usually begins between April and June and terminates in October. It is conducted with a fleet of approximately 130 vessels which operate from reduction plants located at 14 ports along the coast (fig. 1) and exploit the species over most of the range. The "fall" fishery, which runs from November through December or January, has a fleet of approximately 60 vessels along the North Carolina coast. Vessels from a given plant usually operate as a group in nearby waters, although those from adjacent plants often fish in the same waters. When fish are scarce, vessels may range considerable distances from their home port. Fishing is conducted during daylight, and catches normally are landed daily.

Purse seining for menhaden is conducted from two open purse boats. On the fishing grounds, the two purse boats are lashed together, with the seine divided between them, and towed behind a large carrier vessel. An airplane pilot usually locates the fish and directs the laying of the seine by radio contact with the vessel captain. When a school is selected for capture, the seine crews pay out the net while each purse boat completes a half-circle to enclose the fish (see frontispiece). After the seine is pursed, the crew

Figure 1.--Locations of menhaden reduction plants and major areas used in summarizing fishing data.

hauls in the ends and bottom of the net and the catch is pumped into the hold of the carrier vessel. Most purse boats are equipped with a "power block," a mechanical device for hauling the seine. An average purse seine set yields from about 20 to 25 tons of fish. Detailed descriptions of the carrier vessels, purse boats, and gear are given by June and Reintjes (1957, 1959).

## DATA SOURCE AND METHODS
## COMPILATION

Information recorded in logbooks kept aboard the carrier vessels and records of Atlantic menhaden landings at reduction plants were

used to calculate the number and location of purse seine sets in five fishing seasons, 1955-59[2]. A description of the logbook used aboard the vessel to record catch information was given by June and Reintjes (1959). The number of sets, the location of each set in a unit area of 10 minutes of latitude and 10 minutes of longitude (fig. 2), and an estimate of the quantity of fish caught in each set were recorded for each day's fishing by vessel captains or pilots. Over 500 logbooks, listing catch information on more than 80,000 sets,

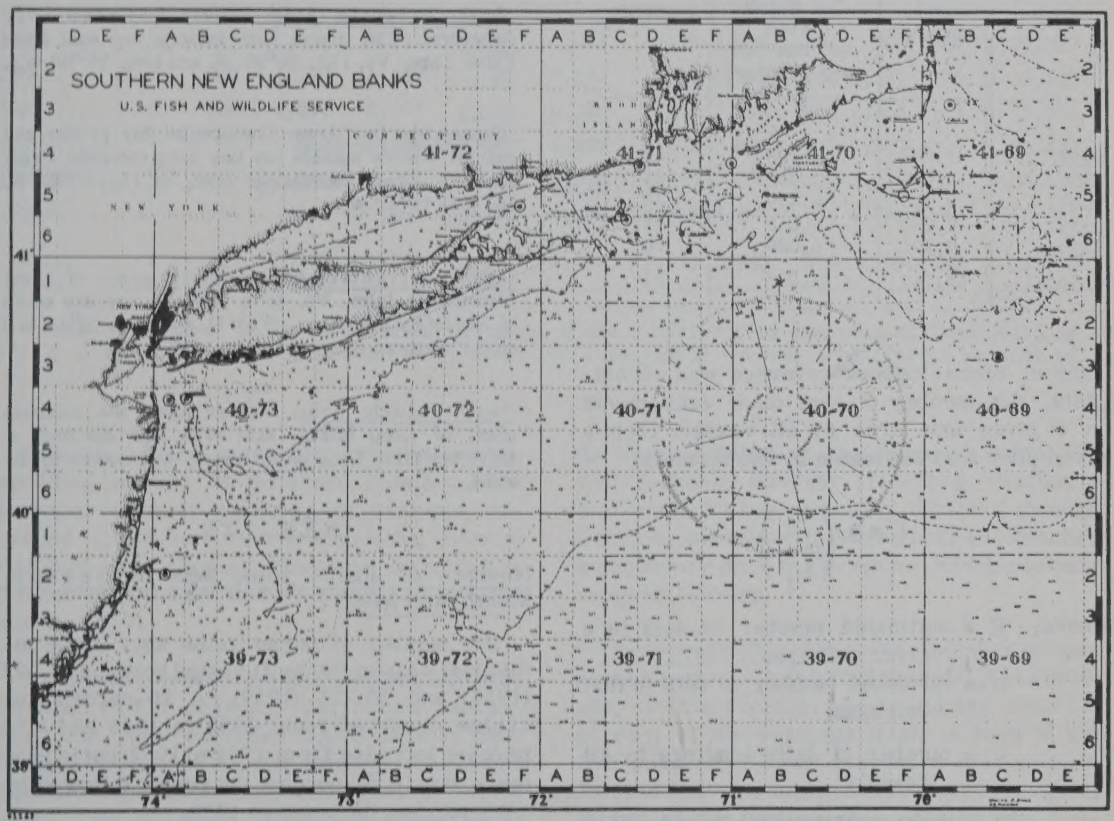


Figure 2.--Example of one of the reference charts used in the location of Atlantic Menhaden purse seine catches.

were made available for analysis. Additional data were obtained from interviews with crew members of vessels on which logbooks were not kept. It was assumed that (1) each purse seine set recorded in the logbooks was made on a single school of Atlantic menhaden and (2) successful and unsuccessful sets were recorded indiscriminately. The total number of vessel landings given in reduction plant records, the corresponding number of vessel landings for which catch information was obtained, and the percent coverage for each fishing season are listed in table 1.

The number of sets recorded in logbooks of vessels operating from an individual plant was tabulated by unit areas, and by month and

[2] Since purse seine fishing usually is continuous from April through January of the following calendar year, this period is referred to in this report as the annual fishing season.

TABLE 1.--Daily purse seine vessel landings of Atlantic menhaden, landings for which catch information was obtained, and percent coverage, by season, 1955-59.

| Season | Total vessel landings | Vessel landings for which catch information was obtained | Coverage |
|---|---|---|---|
| 1955..... | 8,822 | 3,728 | 42 |
| 1956..... | 9,756 | 4,352 | 45 |
| 1957..... | 9,345 | 4,479 | 48 |
| 1958..... | 7,830 | 4,615 | 59 |
| 1959..... | 9,994 | 6,029 | 60 |
| Total.. | 45,747 | 23,203 | 51 |

season. Since logbook coverage was incomplete, the number of sets made each month in a given unit area by all vessels from a given plant was estimated by the formula:

$$E = n\left(\frac{L_c}{L_i}\right)$$

where: $E$ = estimated number of sets in a given unit area

$n$ = tabulated number of sets in that unit area

$L_c$ = number of daily landings by all vessels[3]

$L_i$ = number of daily landings by those vessels from which effort data were obtained

Vessels from different plants often fished in the same unit areas during a month; therefore, the estimated numbers of sets in each unit area by vessels from the different plants were summed to obtain the monthly total for the unit area.

Seasonal totals were obtained by summing the monthly unit area totals. These also were summed by larger geographical areas. Four such areas were used; these were described by June and Reintjes (1959) in their summary of the biostatistical data on catch (fig. 1) and are as follows:

South Atlantic Area: Waters between Cape Canaveral, Fla. and a line running due east from False Cape, Va. (lat. 36°35' N. and long. 75°53' W.).

Chesapeake Bay Area: Chesapeake Bay proper and coastal waters outside the Bay lying between False Cape and Great Machipongo Inlet, Va. (lat. 37°22' N. and long 75°43' W.).

Middle Atlantic Area: Waters north of great Machipongo Inlet, Va. to a line running due south of Moriches Inlet (lat. 40°46' N. and long. 72°44' W.) on the southern coast of Long Island, N. Y.

North Atlantic Area: Waters along the southern coast of Long Island, east of a line due south of Moriches Inlet, Long Island Sound, and waters northward.

## RESULTS

### Number of Purse Seine Sets by Season, Month, and Area

The number of purse seine sets in the individual season (table 2) varied between 26,522 (1958) and 35,725 (1959). A 20-percent increase occurred from 1955 to 1956 and a 5-percent increase from 1956 to 1957; but in 1958 there was a 24-percent decrease, followed by a 35-percent increase in 1959.

There were similarities in the monthly distribution of sets among seasons. There was no fishing in February in any season; in two of the five seasons, some fishing occurred in March; and, in four seasons, a relatively small amount occurred in April. In each season, the number of sets increased during the summer and, in four of the five seasons, reached a maximum in July. From June through September, the number of sets remained relatively constant from season to season and accounted for between 81 and 84 percent of the seasonal total. Fishing decreased through the fall months and terminated in the following January. In four of the five seasons, however, the number of sets in December exceeded that in November.

[3] Equating each vessel landing with a day's fishing is considered justified, since catches normally are landed at the end of each day's fishing.

TABLE 2.--Estimated number of purse seine sets for Atlantic menhaden, by month, 1955-59

(Month of maximum fishing underscored)

| Season | Month | | | | | | | | | | | Total[1] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mar. | Apr. | May | June | July | Aug. | Sep. | Oct. | Nov. | Dec. | Jan. | |
| 1955..... | 4 | 248 | 1,396 | 5,835 | 7,289 | 4,966 | 4,459 | 2,010 | 943 | 508 | 169 | 27,827 |
| 1956..... | - | 202 | 1,499 | 6,587 | 8,520 | 7,576 | 4,700 | 1,922 | 1,036 | 1,177 | 198 | 33,417 |
| 1957..... | 8 | 106 | 1,897 | 5,973 | 8,672 | 8,300 | 5,879 | 2,990 | 566 | 666 | 13 | 35,070 |
| 1958..... | - | - | 849 | 4,244 | 6,667 | 4,907 | 6,572 | 868 | 931 | 1,367 | 117 | 26,522 |
| 1959..... | - | 7 | 2,006 | 7,223 | 7,558 | 8,506 | 6,255 | 2,108 | 898 | 1,128 | 36 | 35,725 |
| Total.. | 12 | 563 | 7,647 | 29,862 | 38,706 | 34,255 | 27,865 | 9,898 | 4,374 | 4,846 | 533 | 158,561 |
| Mean... | 2 | 113 | 1,529 | 5,972 | 7,741 | 6,851 | 5,573 | 1,980 | 875 | 969 | 107 | 31,712 |

[1] Numbers of purse seine sets listed in tables 2 and 3 differ from measures of total fishing effort given by June and Reintjes (1959, 1960) and June (1961) because of different methods of calculation.

Fishing varied markedly between corresponding months in different seasons. Differences between seasons, for example, exceeded 2,000 sets in the 5 months, June to October. The largest difference occurred in August (4,907 sets in 1958 compared to 8,506 sets in 1959).

Large differences existed between adjacent months within seasons. Variations between May and June exceeded 3,000 sets in each season. In two of the five seasons, variations between September and October exceeded 4,000 sets. The greatest difference occurred in 1958 when the number of sets decreased from 6,752 in September to 868 in October.

The number of sets in the major areas, by season and month, is given in table 3, with the mean number of sets shown in figure 3.

South Atlantic Area: The number of sets varied between 4,560 (1957) and 7,144 (1959) and averaged about 18 percent of the total. The fishing season was longer than in any of the other areas. Month of maximum fishing varied markedly between seasons. In 1955, the greatest number of sets was made in November; in 1956 and 1958, in December; in 1957, in May; and in 1959, in June. Based on the mean number of sets by month during the five seasons, however, fishing reached a maximum in June, steadily declined through October, increased in November, and reached a secondary peak in December. Fishing terminated in January.

Chesapeake Bay Area: The number of sets varied between 4,863 (1955) and 11,887 (1959) and, on the average, accounted for about 26 percent of the seasonal total. In four of the five seasons, fishing reached a maximum in July; in 1959 the maximum occurred in August. In two of the five seasons, fishing was conducted in November. Based on the mean number of sets by month for all seasons, fewer sets were made in August than in July or September.

Middle Atlantic Area: The greatest number of sets made in this area in each season varied between 9,803 (1958) and 17,828 (1957) and during the five seasons averaged about 45 percent of the total. In three out of five seasons, fishing reached a maximum in August. In 1955, the maximum occurred in July; and in 1958, in September. There was a tendency for fishing to reach a maximum later in the season in the Middle Atlantic Area than in the Chesapeake Bay or South Atlantic Areas.

TABLE 3.--Estimated number of purse seine sets for Atlantic menhaden, by area and month, 1955-59

(Month of maximum fishing underscored)

| Area and season | Month | | | | | | | | | | | Total[1] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mar. | Apr. | May | June | July | Aug. | Sep. | Oct. | Nov. | Dec. | Jan. | |
| South Atlantic: | | | | | | | | | | | | |
| 1955..... | 4 | 248 | 613 | 869 | 760 | 423 | 111 | 160 | 890 | 508 | 169 | 4,755 |
| 1956..... | - | 202 | 905 | 897 | 643 | 597 | 367 | 92 | 1,036 | 1,177 | 198 | 6,114 |
| 1957..... | 8 | 106 | 951 | 793 | 518 | 513 | 329 | 97 | 566 | 666 | 13 | 4,560 |
| 1958..... | - | - | 613 | 896 | 1,118 | 628 | 693 | 152 | 931 | 1,367 | 117 | 6,515 |
| 1959..... | - | 7 | 799 | 1,579 | 1,079 | 922 | 525 | 193 | 876 | 1,128 | 36 | 7,144 |
| Total.... | 12 | 563 | 3,881 | 5,034 | 4,118 | 3,083 | 2,025 | 694 | 4,299 | 4,846 | 533 | 29,088 |
| Mean..... | 2 | 113 | 776 | 1,007 | 824 | 617 | 405 | 139 | 860 | 969 | 107 | 5,818 |
| Chesapeake Bay: | | | | | | | | | | | | |
| 1955..... | - | - | 90 | 947 | 1,327 | 1,125 | 966 | 355 | 53 | - | - | 4,863 |
| 1956..... | - | - | 183 | 1,380 | 2,045 | 1,751 | 1,319 | 448 | - | - | - | 7,126 |
| 1957..... | - | - | 321 | 1,663 | 2,462 | 2,423 | 2,215 | 465 | - | - | - | 9,549 |
| 1958..... | - | - | 190 | 1,832 | 2,430 | 1,232 | 2,274 | 327 | - | - | - | 8,285 |
| 1959..... | - | - | 698 | 2,275 | 1,975 | 2,942 | 2,741 | 1,234 | 22 | - | - | 11,887 |
| Total.... | - | - | 1,482 | 8,097 | 10,239 | 9,473 | 9,515 | 2,829 | 75 | - | - | 41,710 |
| Mean..... | - | - | 296 | 1,619 | 2,048 | 1,895 | 1,903 | 566 | 15 | - | - | 8,342 |
| Middle Atlantic: | | | | | | | | | | | | |
| 1955..... | - | - | 691 | 3,199 | 3,711 | 2,481 | 2,775 | 1,258 | - | - | - | 14,115 |
| 1956..... | - | - | 411 | 4,016 | 4,301 | 4,365 | 2,446 | 1,128 | - | - | - | 16,667 |
| 1957..... | - | - | 619 | 3,263 | 4,342 | 4,486 | 2,845 | 2,273 | - | - | - | 17,828 |
| 1958..... | - | - | 46 | 1,335 | 2,507 | 2,526 | 3,254 | 135 | - | - | - | 9,803 |
| 1959..... | - | - | 503 | 3,022 | 3,320 | 3,345 | 2,074 | 646 | - | - | - | 12,910 |
| Total.... | - | - | 2,270 | 14,835 | 18,181 | 17,203 | 13,394 | 5,440 | - | - | - | 71,323 |
| Mean..... | - | - | 454 | 2,967 | 3,636 | 3,441 | 2,679 | 1,088 | - | - | - | 14,265 |
| North Atlantic: | | | | | | | | | | | | |
| 1955..... | - | - | 2 | 820 | 1,491 | 937 | 607 | 237 | - | - | - | 4,094 |
| 1956..... | - | - | - | 294 | 1,531 | 863 | 568 | 254 | - | - | - | 3,510 |
| 1957..... | - | - | 6 | 254 | 1,350 | 878 | 490 | 155 | - | - | - | 3,133 |
| 1958..... | - | - | - | 181 | 612 | 521 | 351 | 254 | - | - | - | 1,919 |
| 1959..... | - | - | 6 | 347 | 1,184 | 1,297 | 915 | 35 | - | - | - | 3,784 |
| Total.... | - | - | 14 | 1,896 | 6,168 | 4,496 | 2,931 | 935 | - | - | - | 16,440 |
| Mean .... | - | - | 3 | 379 | 1,234 | 899 | 586 | 187 | - | - | - | 3,288 |

[1] See footnote, table 2,p. 15.

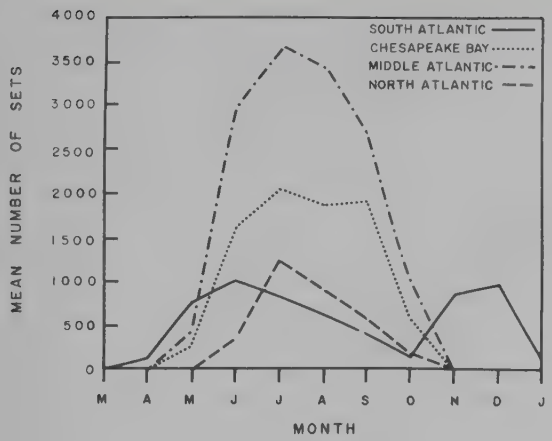


Figure 3.--Mean number of seine sets in the major areas, by month, 1955-59.

North Atlantic Area: The number of sets was consistently least in this area and, in the individual seasons, varied between 1,919 (1958) and 4,094 (1955). The seasonal total averaged about 11 percent of the total for all areas. In contrast to other areas, there was noticeably less fishing in May and June. In four of the five seasons, maximum fishing occurred in July. In 1959 fishing reached a maximum in August.

## Geographical Distribution of Fishing by Month

The geographical distribution of the mean number of purse seine sets in each unit area, by month, for the five fishing seasons (figs. 4 and 5) furnished a measure of the distribution of fish in the coastal waters. As noted in the previous section (p. 4), there was no fishing in February in any season; and in two of the five seasons, some fishing took place in March in the vicinity of Fernandina Beach, Fla. Fishing in April was confined to southern waters. Except for several localities along the Georgia, South Carolina, North Carolina, and southern New England coasts, fishing occurred in May from Florida to Massachusetts, with moderate fishing (100-199 sets) off Cape Fear and Cape Lookout, N. C. The number of sets increased in June concurrent with a northward extension of fishing into the Gulf of Maine, and intense fishing (200 sets or more) occurred in Chesapeake Bay and off Sandy Hook, N. J. Distribution of fishing was similar in July, but there was a marked increase in the number of sets, particularly from Chesapeake Bay northward. In August, there was a noticeable decrease in fishing south of Cape Lookout, in Chesapeake Bay, and north of Cape Cod, Mass. By September, fishing further diminished in southern waters. It remained relatively intense in Chesapeake Bay and diminished north of Delaware Bay. The distribution of fishing north of Cape Hatteras, N. C., in October resembled that in May, but south of that location, there was little fishing. Except for scattered sets made in the vicinity of Chesapeake Bay, South Carolina, and Florida, fishing during November, December, and January was confined to the North Carolina coast.

Variations in the geographical distribution of the number of sets by month, April through January, are shown in figures 6 through 15.

April: With the exception of 1958, when there were no sets made along the entire coast (fig. 6), fishing was generally limited to northern Florida and southern Georgia. In 1955 and 1957, some fishing also occurred off Cape Fear.

May: The most noteworthy variations (fig. 7) occurred in 1958, when fishing extended no farther northward than Delaware Bay; and in 1959, when fishing was widespread and reached northward to Narragansett Bay, R. I. Other localities where fishing was inconsistent between seasons were off South Carolina and New Jersey.

June: South of Cape Hatteras, fishing (fig. 8) was variable off the coast of South Carolina and between Cape Fear and Cape Lookout. With minor variations, the distribution of sets was similar each season from Chesapeake Bay northward to Cape Cod, although in 1959, there was little fishing off the Eastern Shore of Virginia and Maryland. From 1955 to 1958, fishing diminished north of Cape Cod, and there was only one year (1955) when fishing occurred off Maine.

July: The distribution of fishing (fig. 9) shifted markedly between seasons south of Cape Lookout. The greatest variations over the entire coast, however, occurred in 1958

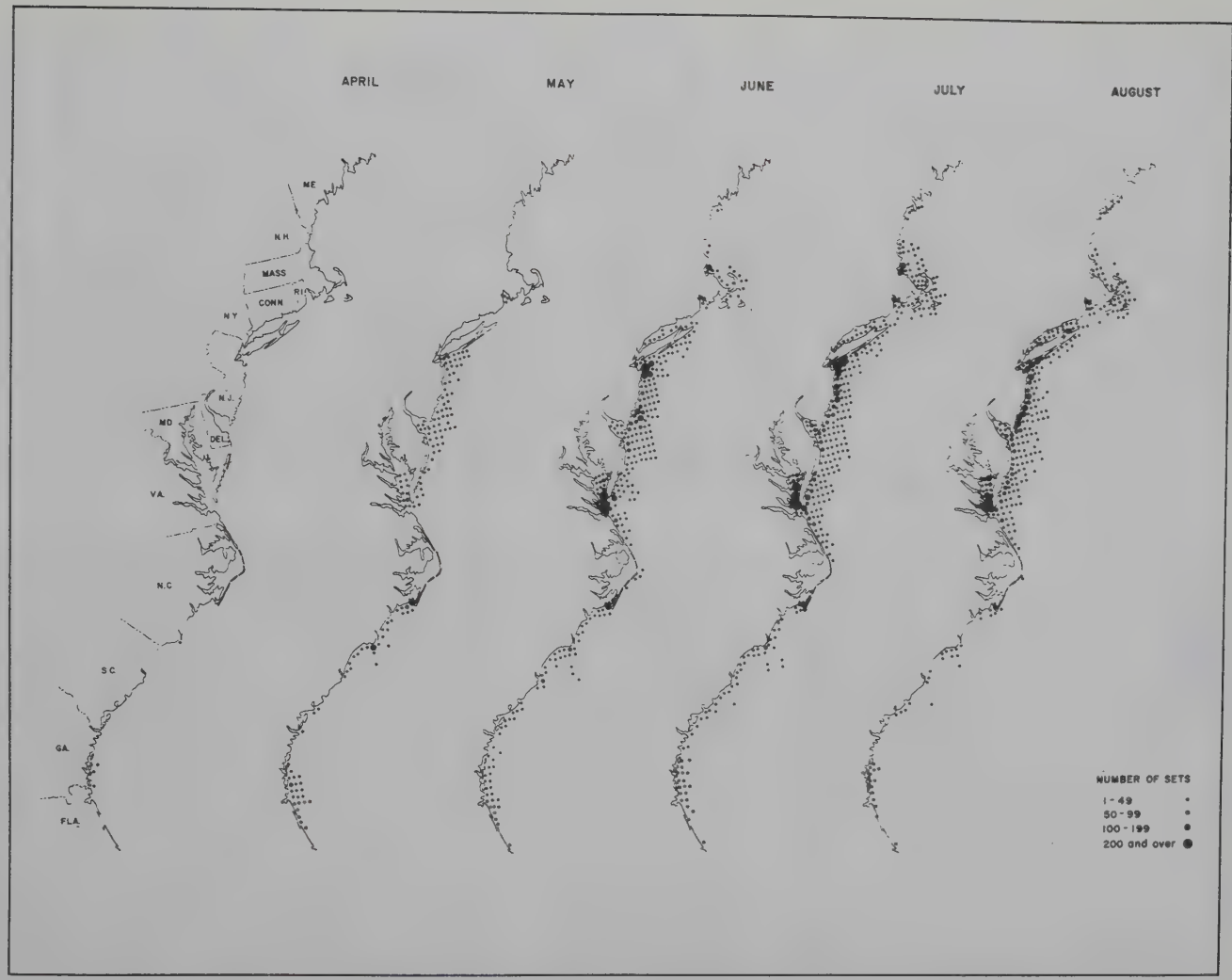


Figure 4.--Distribution of the mean number of purse seine sets, April through August, 1955-59.

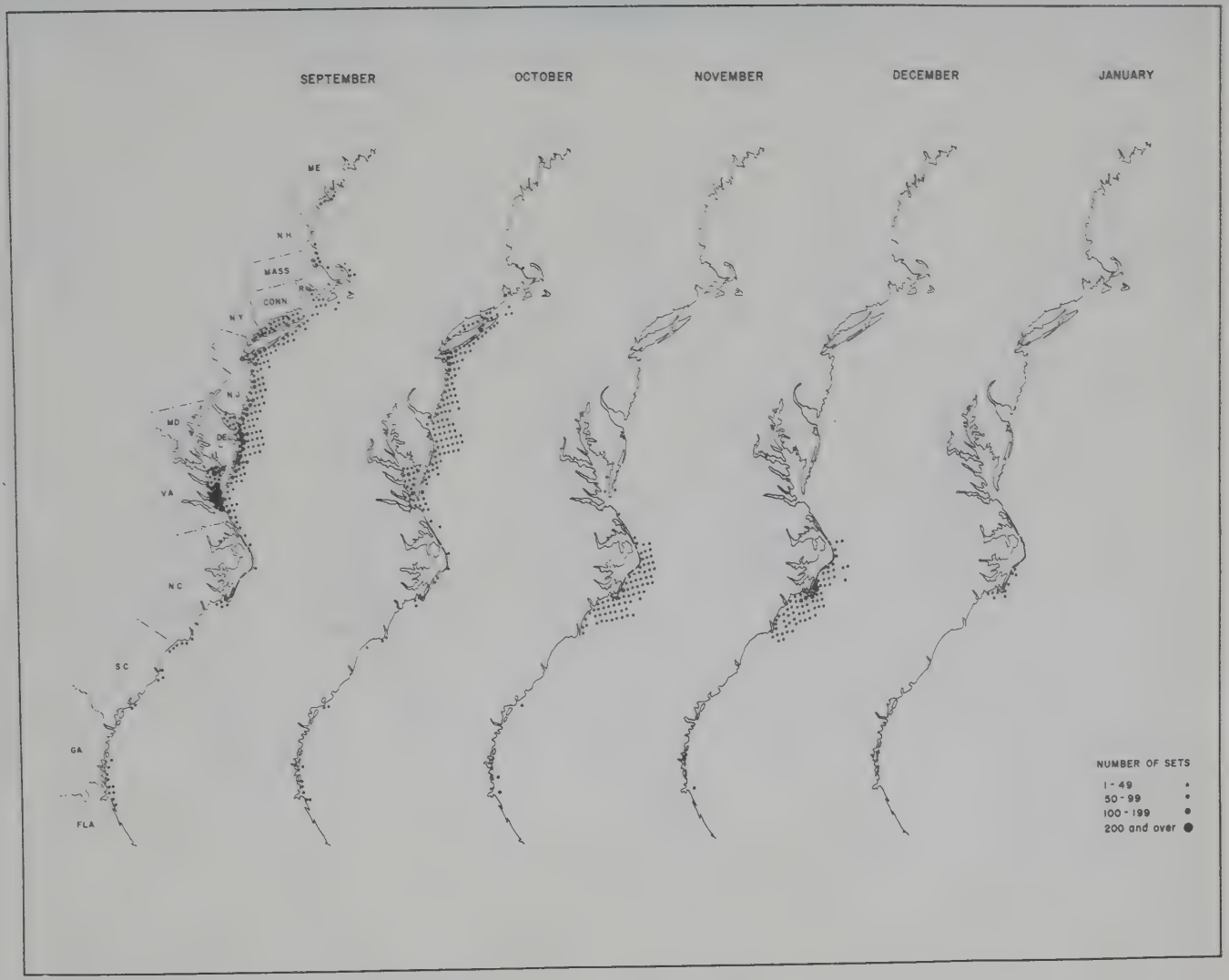


Figure 5.--Distribution of the mean number of purse seine sets, September through January, 1955-60.

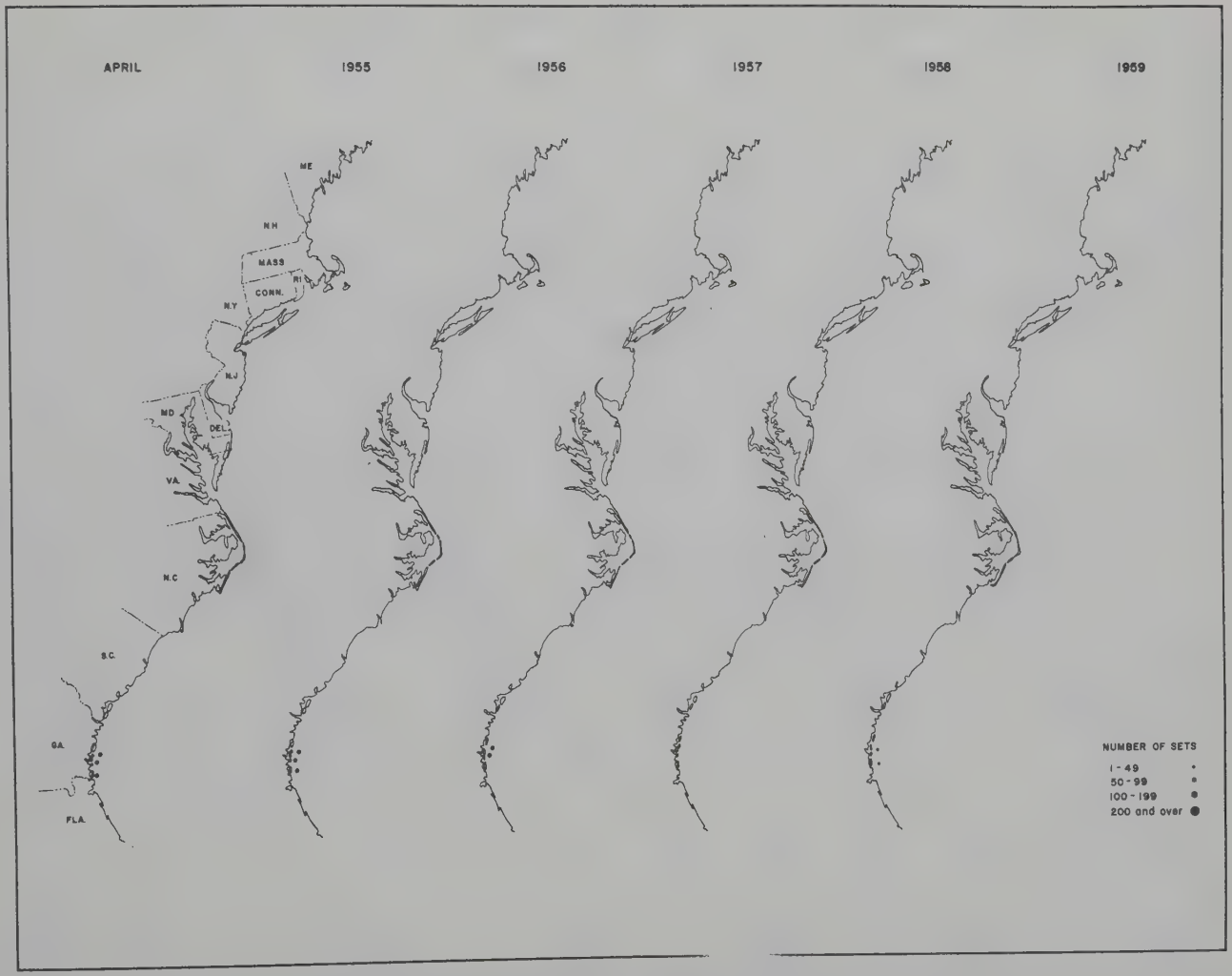


Figure 6.--Distribution of purse seine sets in April, 1955-59.

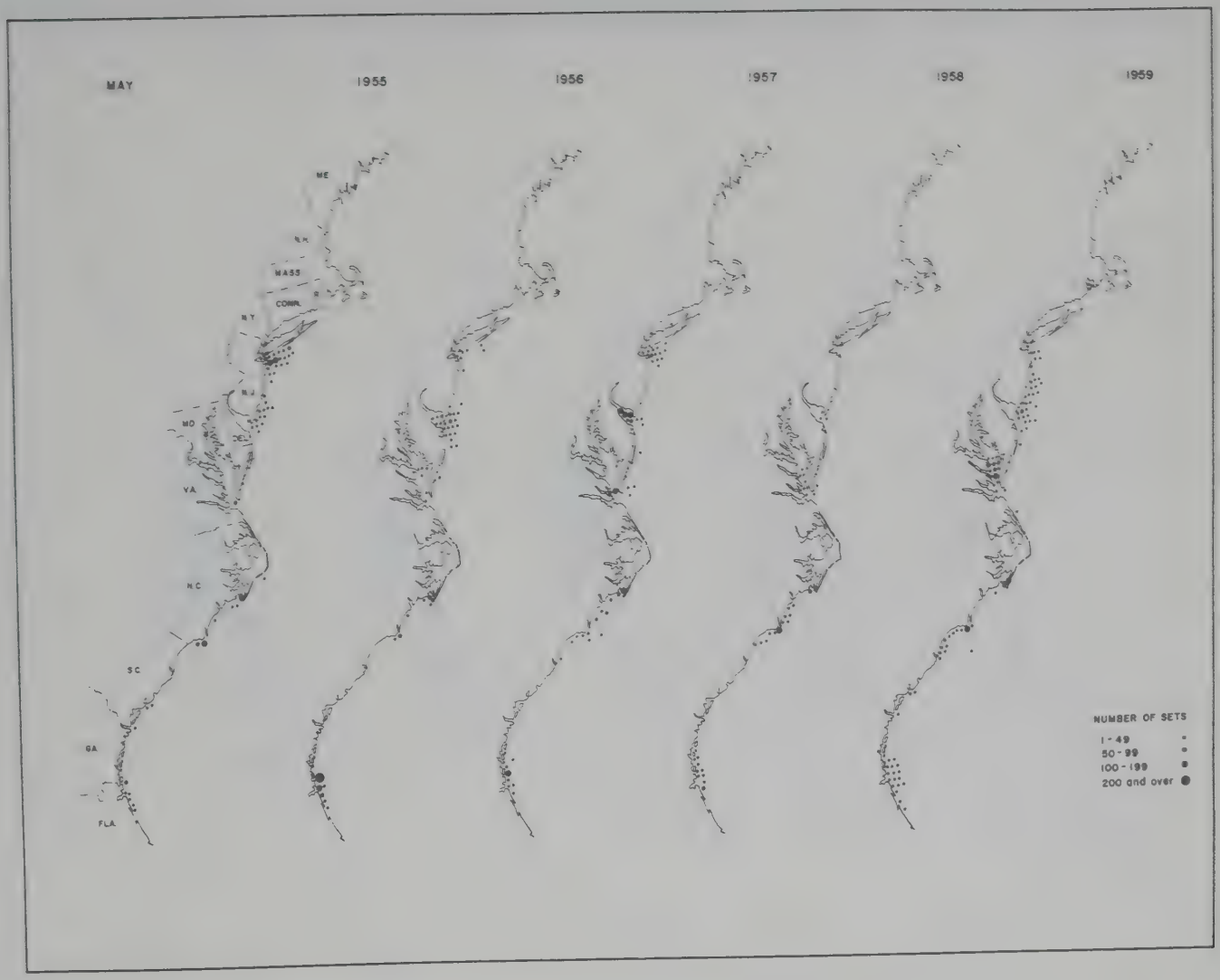


Figure 7.--Distribution of purse seine sets in May, 1955-59.

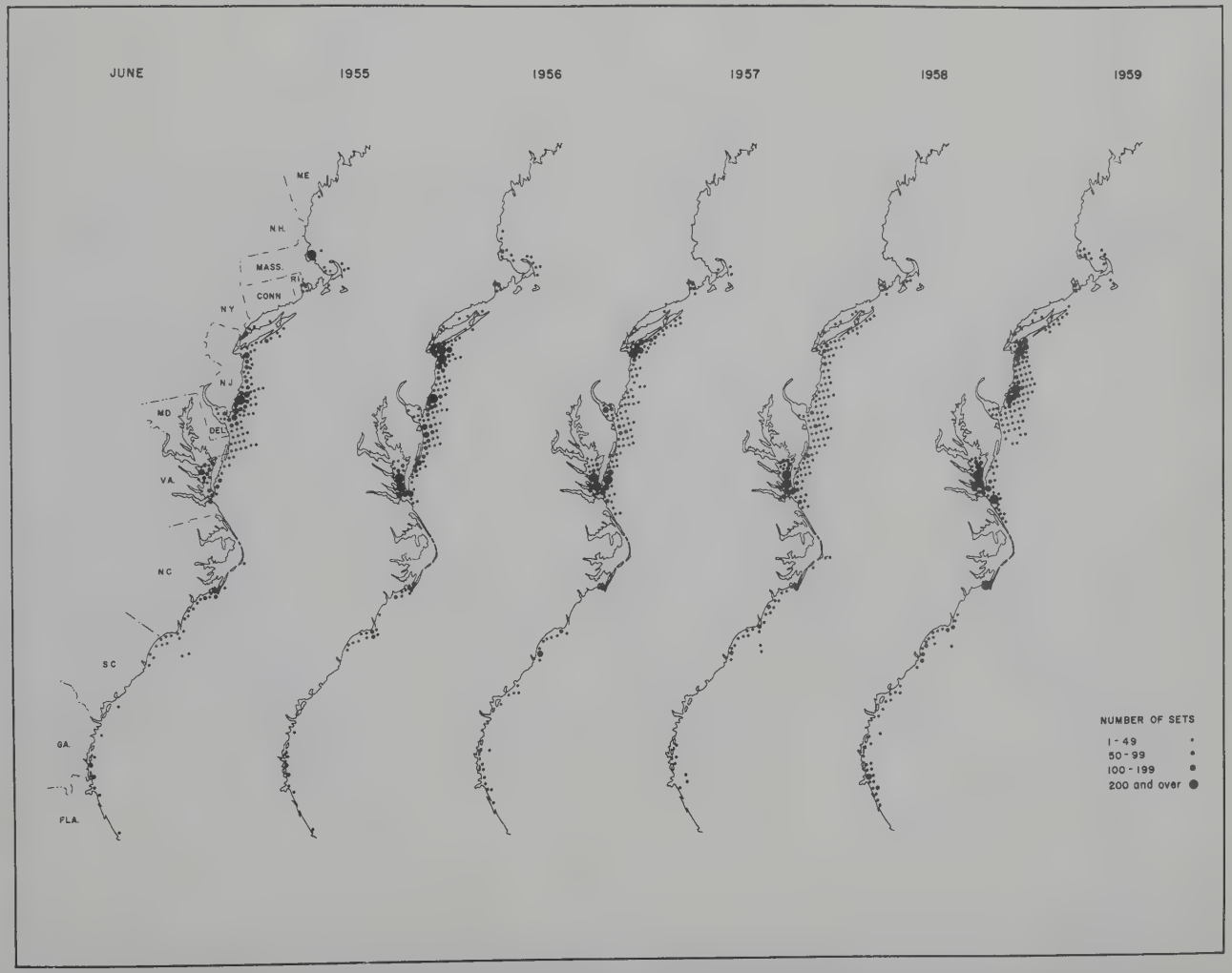


Figure 8.--Distribution of purse seine sets in June, 1955-59.

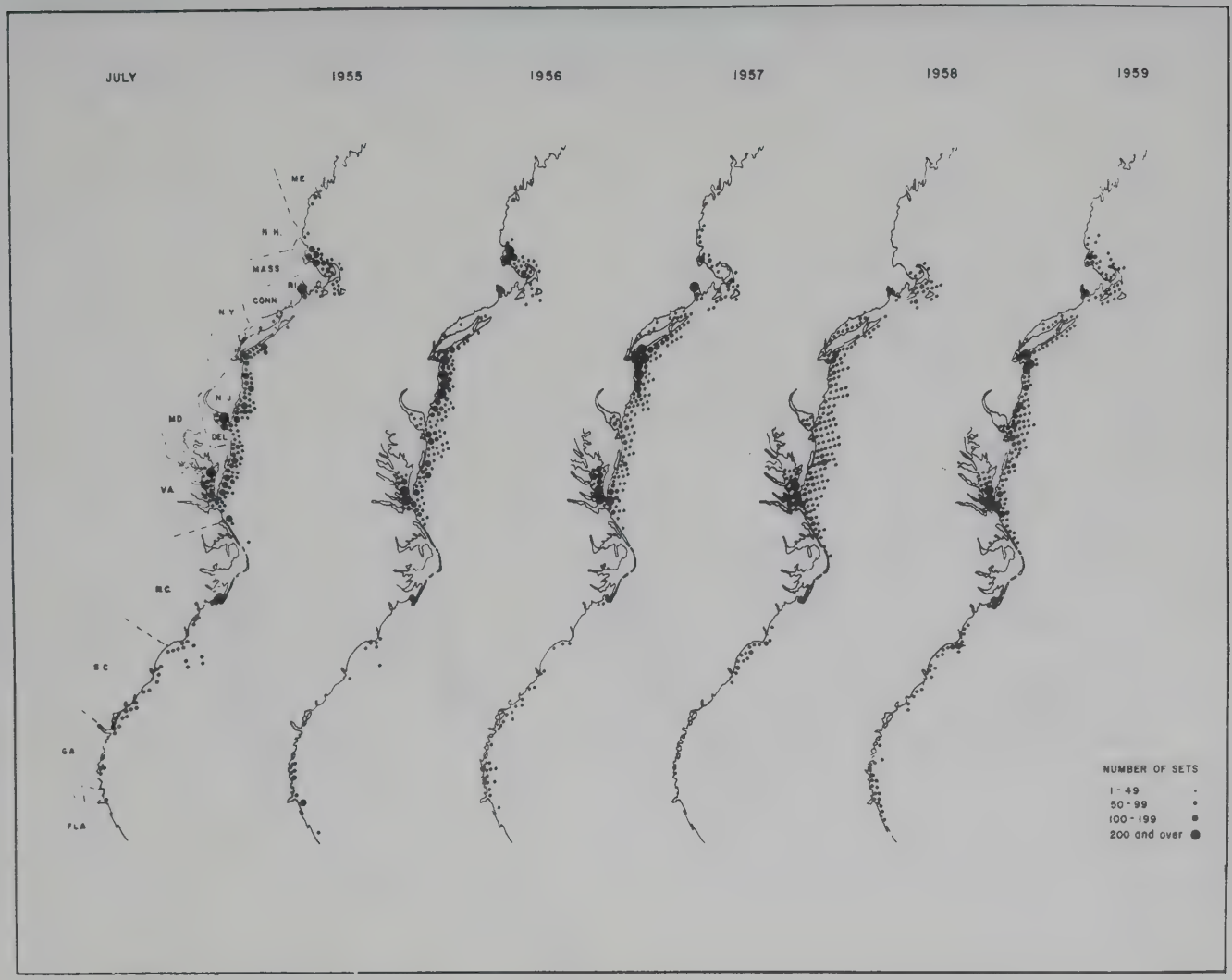


Figure 9.--Distribution of purse seine sets in July, 1955-59.

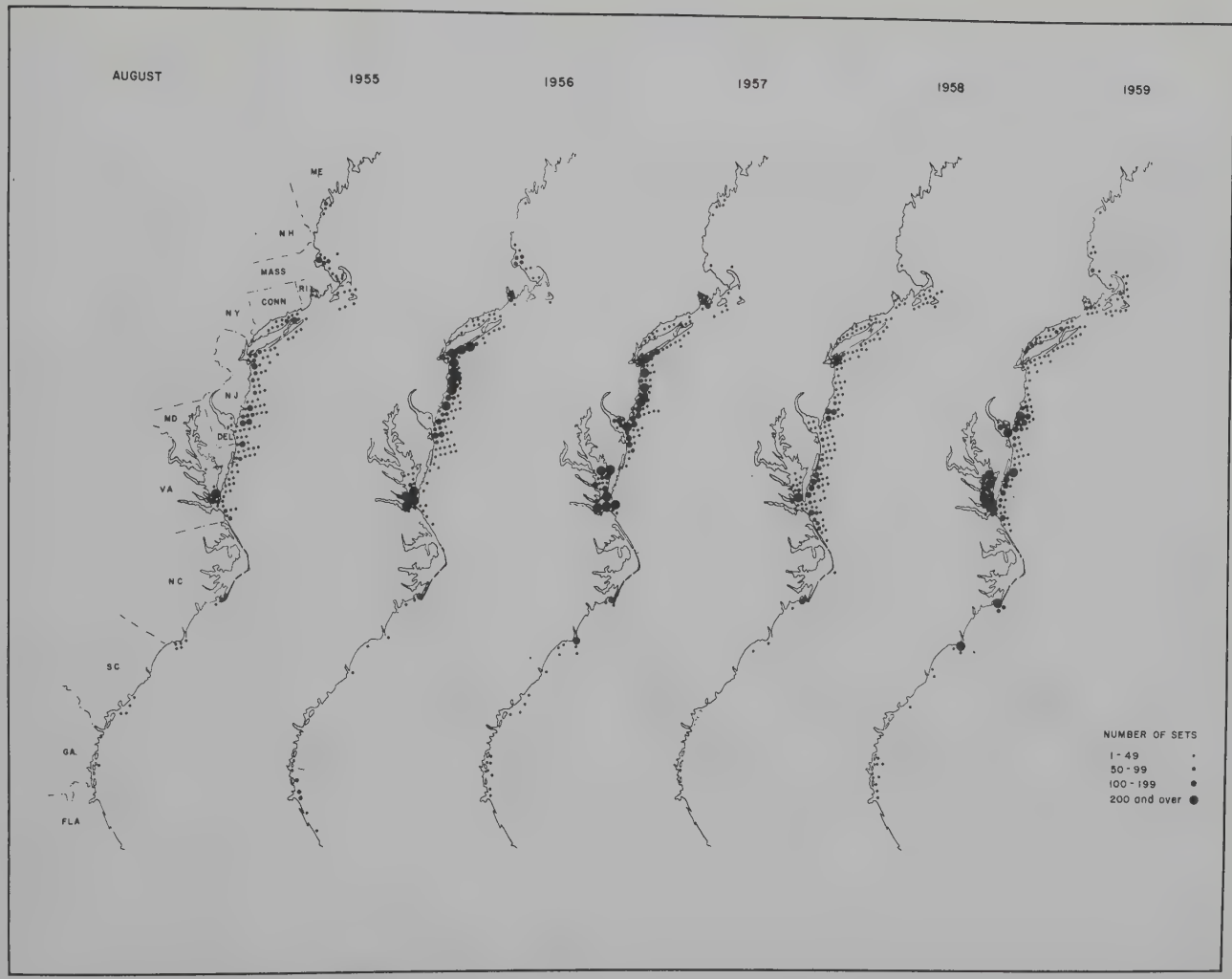


Figure 10.--Distribution of purse seine sets in August, 1955-59.

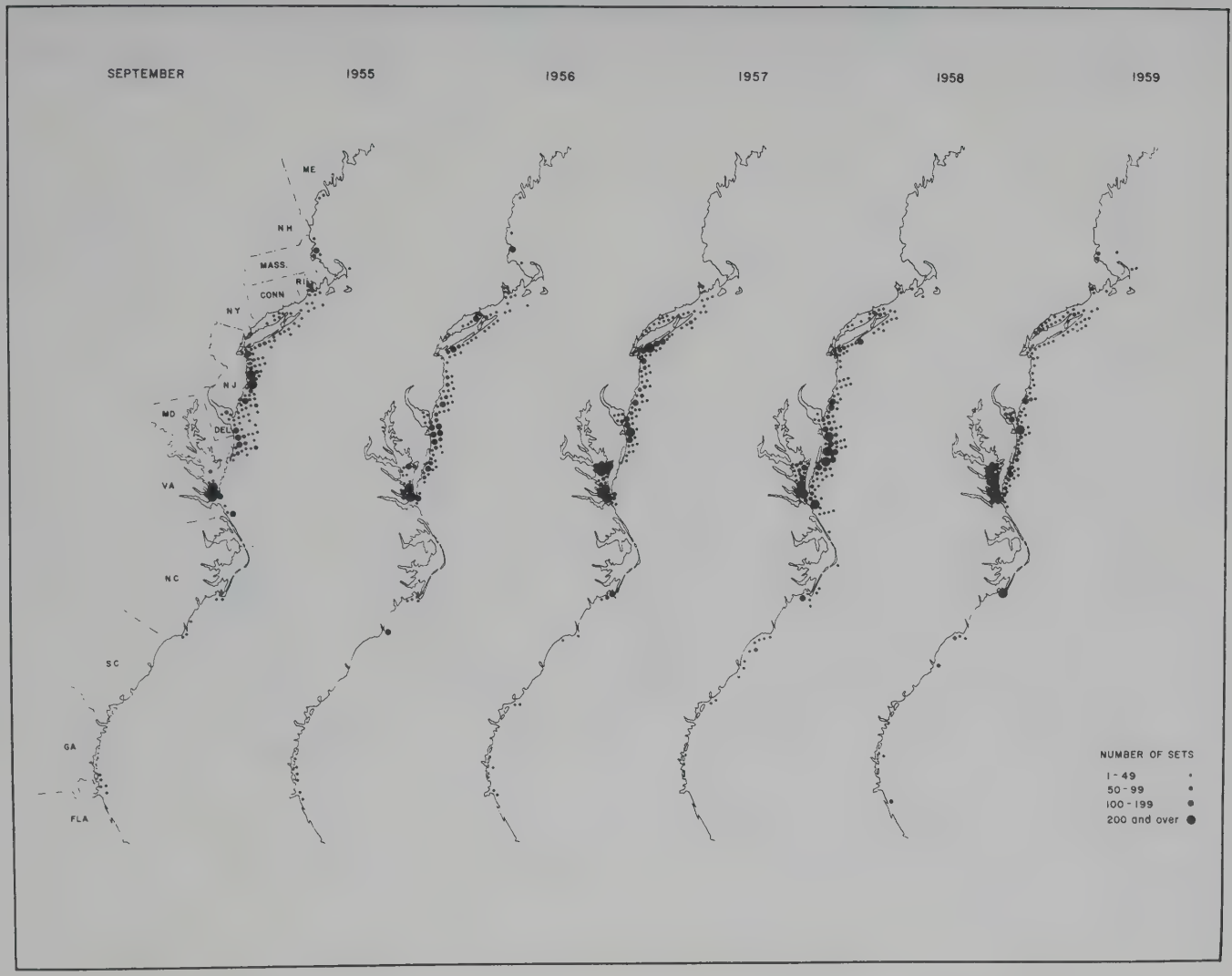


Figure 11.--Distribution of purse seine sets in September, 1955-59.

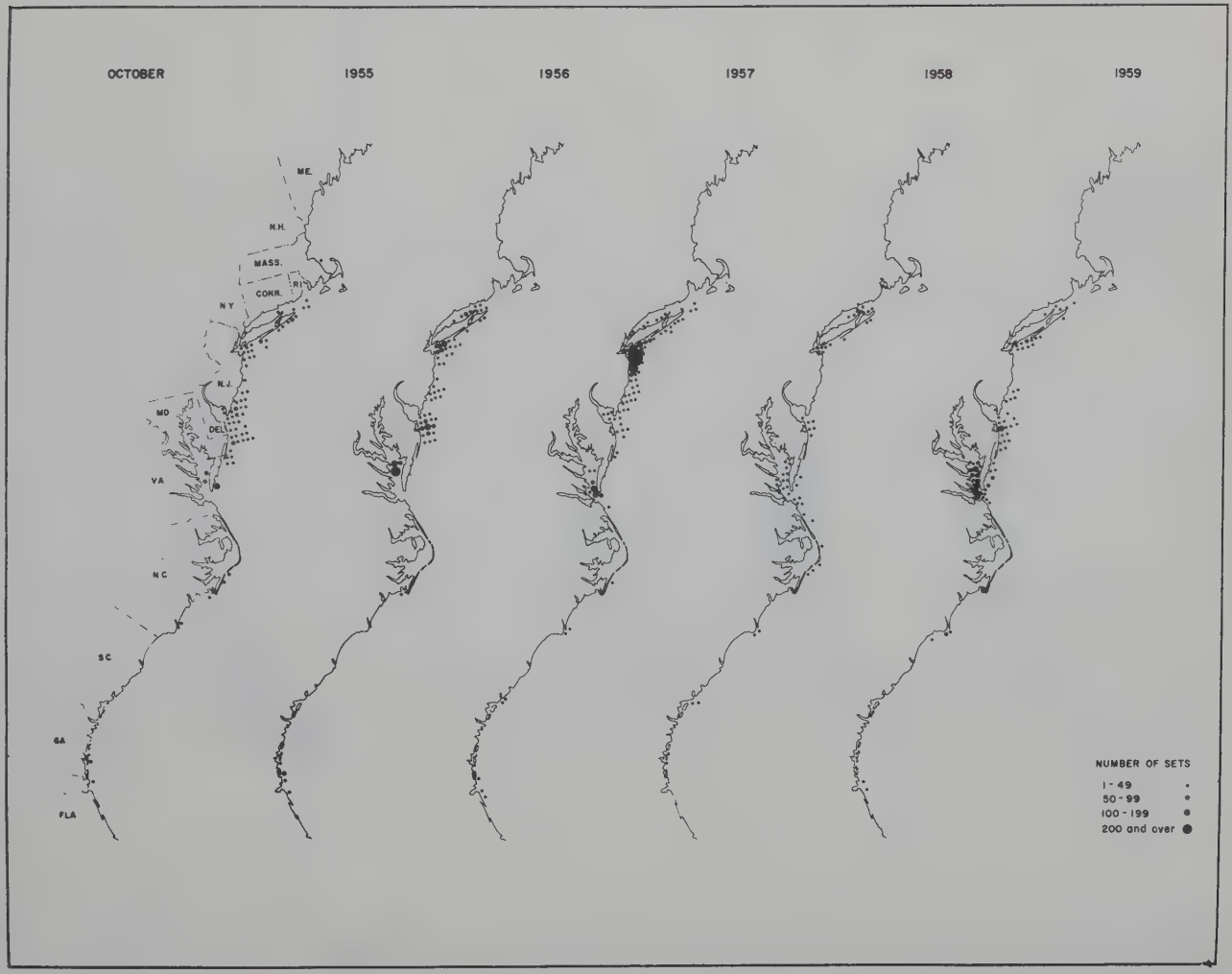


Figure 12.--Distribution of purse seine sets in October, 1955-59.

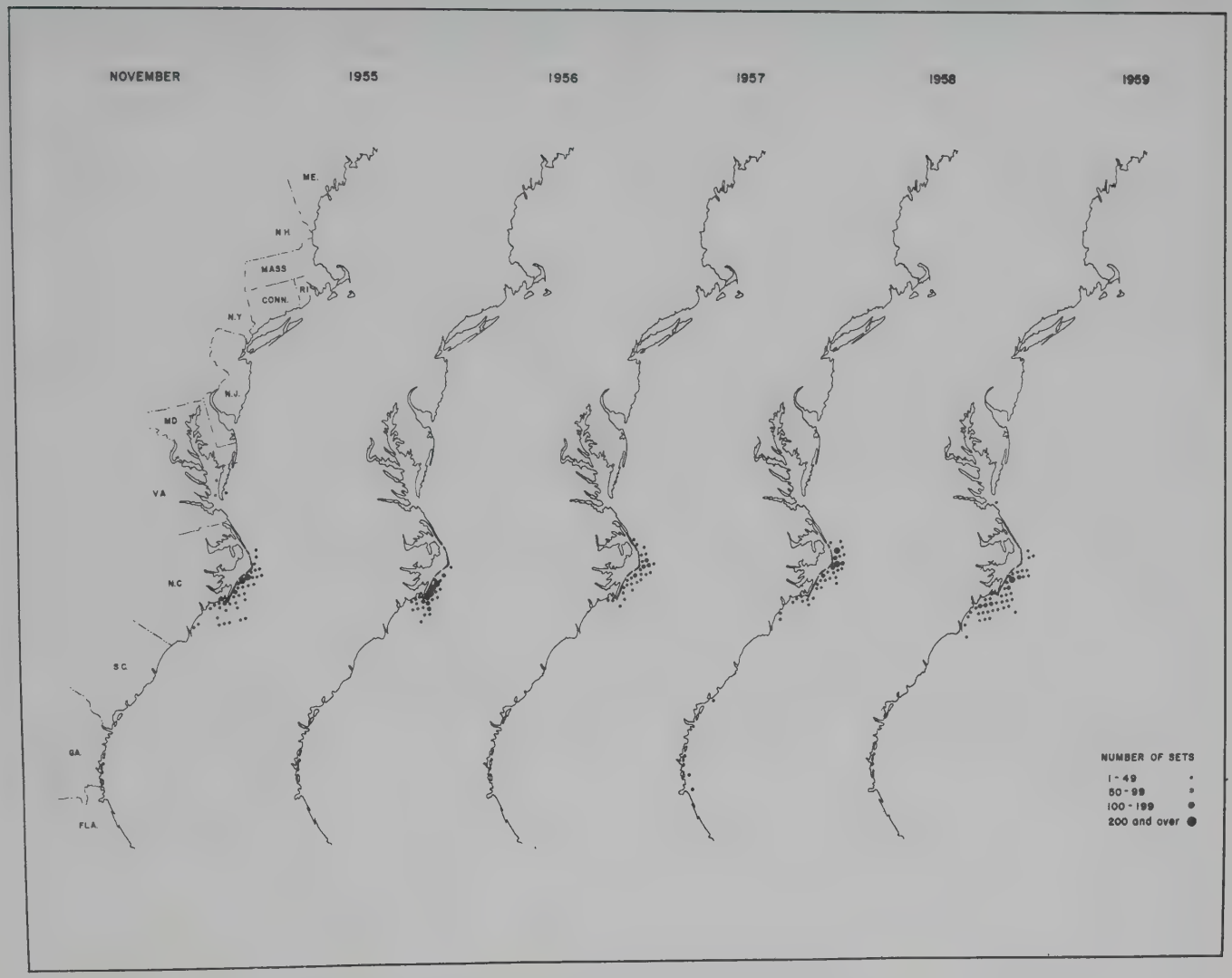


Figure 13.--Distribution of purse seine sets in November, 1955-59.

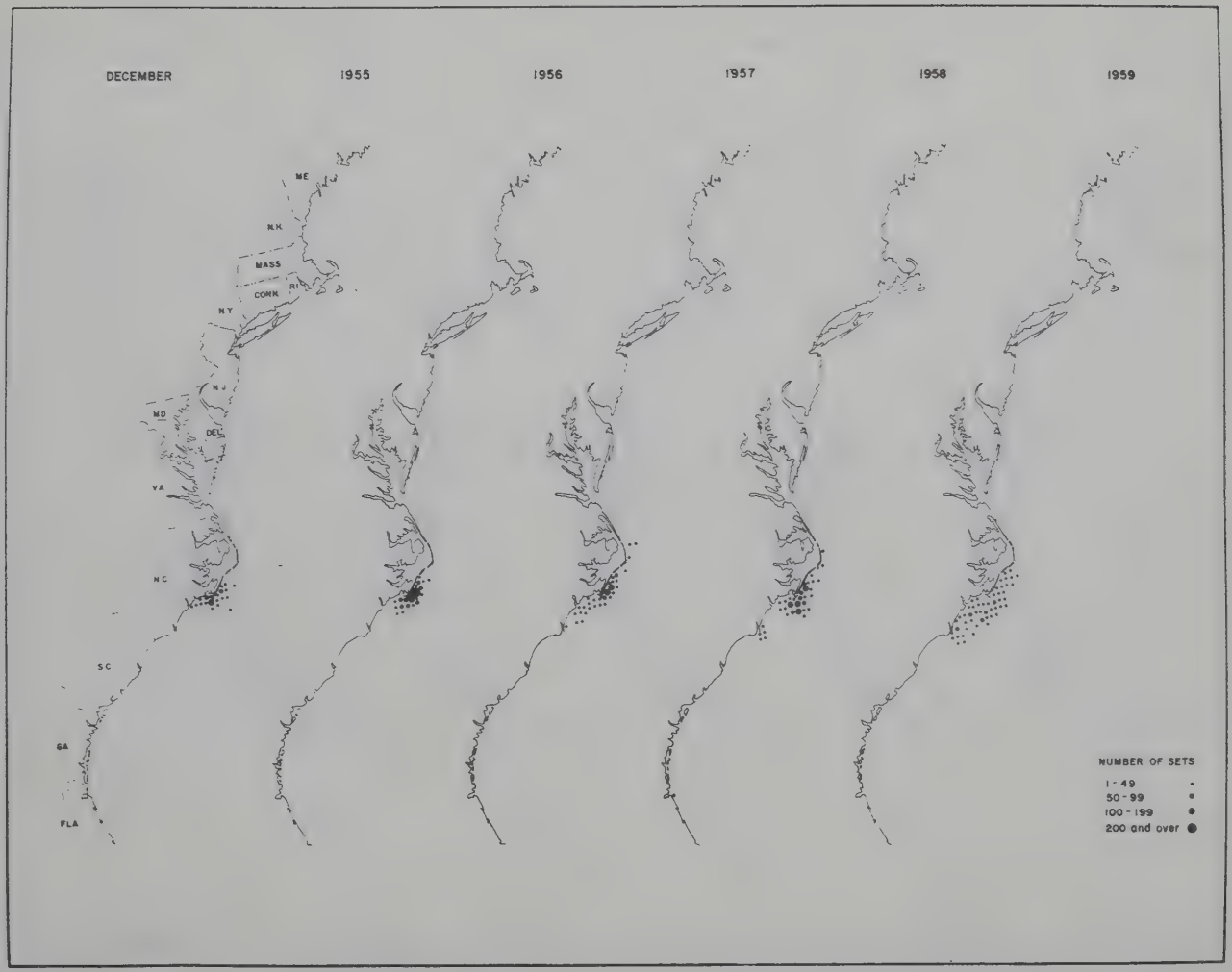


Figure 14.--Distribution of purse seine sets in December, 1955-59.

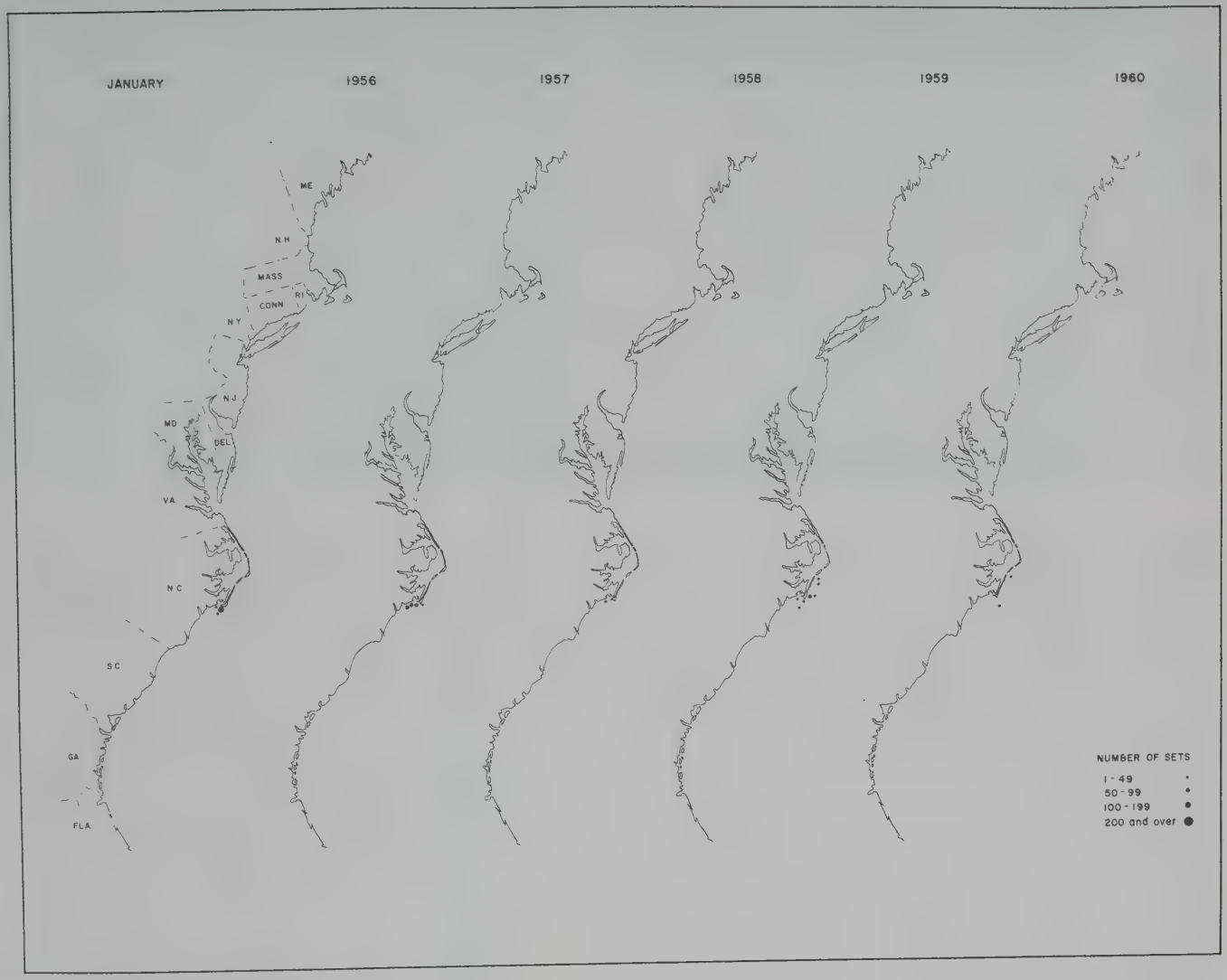


Figure 15.--Distribution of purse seine sets in January, 1956-60.

when (1) there was no fishing south of South Carolina, (2) fishing along the Middle Atlantic coast was conducted farther offshore, and (3) fishing did not occur north of Cape Cod.

August: The most noticeable changes in the distribution of sets (fig. 10) occurred in 1955 when fishing in Chesapeake Bay virtually was limited to the lower bay, in 1957 when there was no fishing off the Eastern Shore of Virginia, and in 1958 when (1) no fishing occurred south of North Carolina and (2) there was little fishing north of Cape Cod.

September: In all seasons, the distribution of sets (fig. 11) was more variable at the extremes of the fishing range. Few sets were made south of Cape Fear; and in two of the five seasons (1957 and 1958), there was no fishing north of Cape Cod. Fishing did not occur along most of the Eastern Shore of Virginia in 1955 and 1957. A reduction in the number of sets was evident along the New Jersey coast in 1958 and 1959.

October: The most conspicuous variations in the distribution of sets (fig. 12) occurred within Chesapeake Bay and along the coast of New Jersey. Some fishing was conducted in the vicinity of Cape Hatteras in 1958.

November: Distribution of sets (fig. 13) varied slightly during the five seasons. Fishing occurred farther offshore in 1955 and 1959 and was confined largely to the vicinity of Cape Lookout in 1956. Some fishing took place in Chesapeake Bay in 1955, and a few sets were made off the mouth of the bay in 1959.

December: The distribution of sets (fig. 14) shows that in 1955 and 1956, fishing was concentrated in the vicinity of Cape Lookout; while in 1957, 1958, and 1959, it was more widespread and extended from Cape Hatteras to Cape Fear.

January: Fishing (fig. 15) was restricted to the vicinity of Cape Lookout in 1956, 1957, and 1958; while in 1959 and 1960, it was more widespread.

## APPARENT FISH MOVEMENTS INFERRED FROM THE DISTRIBUTION OF PURSE SEINE SETS

The number and distribution of purse seine sets by month, during five seasons showed a pattern from which movements of Atlantic menhaden may be inferred. The onset of fishing, which was determined by the appearance of schools in the surface waters, indicates that a northward coastal movement of fish could have occurred each spring. In every season, fishing began in March or April off northern Florida and off Cape Fear, N. C. In May, fishing began in the vicinity of Cape Lookout, N. C., Chesapeake Bay, and between Delaware Bay and southern Long Island. Fishing north of Long Island usually did not begin until June (in 1959 fishing occurred in Narragansett Bay, R. I., in May). The concentration of initial fishing in these separate localities in May also suggests an inshore movement of fish toward the larger estuaries.

The number and distribution of sets support the hypothesis of a continued northward, coastal movement of fish in late spring and summer. In every season, fishing during April was limited to northern Florida and Cape Fear. Fishing increased in these localities and extended northward to Cape Lookout in May. In most seasons, the number of sets decreased off northern Florida in June, but increased and was more widely distributed off Georgia, South Carolina, and North Carolina. While fishing decreased during the remaining summer months in all localities south of Cape Lookout, there was an increase farther northward. In Chesapeake Bay, fishing usually reached a maximum in July, while in the Middle Atlantic Area, the maximum usually was not reached until August. In all seasons, there was comparatively little fishing in the North Atlantic Area until July, particularly north of Cape Cod, Mass.

An apparent southward withdrawal of fish from the North Atlantic Area was first evident in August when the number of sets decreased north of Cape Cod and increased in Long Island Sound. Comparatively little fishing occurred north of Cape Cod in September, and in

only one season (1955), fishing occurred there in October. In the Middle Atlantic Area, the decrease in fishing usually did not occur until September. In October, the distribution of fishing closely resembled that in May. In Chesapeake Bay, fishing remained intense through September in contrast to a decrease farther northward. This was the only area north of Cape Hatteras, N. C., where fishing occurred in November.

Entry of fish into North Carolina coastal waters was evident every autumn. The number of sets in November and December approached or exceeded that in any summer month for the South Atlantic Area. In all seasons, fishing occurred farther southward along the North Carolina coast in December than in November. Fishing terminated off Cape Lookout and Cape Fear, which suggests an offshore movement of fish.

## SUMMARY


1. Compilation and analysis of the number and location of purse seine sets recorded in logbooks by vessel captains or pilots and records of landings at reduction plants during five fishing seasons, 1955-59, furnished an estimate of the total number and distribution of sets by purse seine vessels for Atlantic menhaden *(Brevoortia tyrannus)*. Knowledge of the number and distribution of purse seine sets is essential for calculating measures of abundance and determining the effect of fishing on the population.

2. Since Atlantic menhaden occur and are caught in discrete schools during the fishing season, the purse seine set provides a basic measure for use in calculating fishing effort.

3. Catch information was obtained on 42 to 60 percent of the total seasonal landings. Recorded sets were tabulated, by month and fishing season, in unit areas of 10 minutes of latitude and 10 minutes of longitude, and the total number of sets by all vessels was computed.

4. Total seasonal number of sets varied from 26,522 (1958) to 35,725 (1959). Between 81 and 84 percent of the seasonal total was expended from June through September. On the average, 45 percent of the total number of sets during the five seasons occurred in the Middle Atlantic Area; 26 percent in the Chesapeake Bay Area; 18 percent in the South Atlantic Area; and 11 percent in the North Atlantic Area. Grounds heavily fished each season were (1) along the New Jersey and southern Long Island coasts, (2) lower Chesapeake Bay, and (3) off Cape Lookout, N. C. Variations in the number of sets in the different seasons, months, and areas were noted.

5. The number and distribution of sets were used to infer movements of Atlantic menhaden. A northward, coastal movement was indicated in spring, followed by an apparent reversal, beginning in August. Fish entered the coastal waters of North Carolina in November and disappeared by January.


## ACKNOWLEDGMENT


Processing plant operators made their catch records available, and some vessel captains and pilots kept detailed logs of daily fishing activities.


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